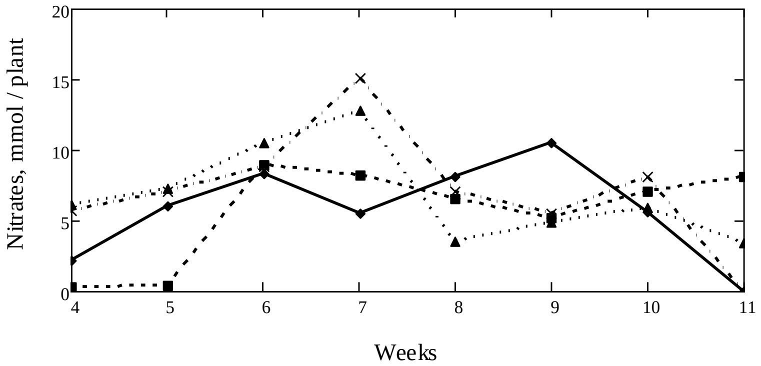

Figure 7. Dynamics of nitrates (mmol/plant) in tomato plants. - ♦ - ♦- variant 1, - ■ - ■ - variant 2, •▲• ▲•variant 3, - • -×- • -× variant 4.

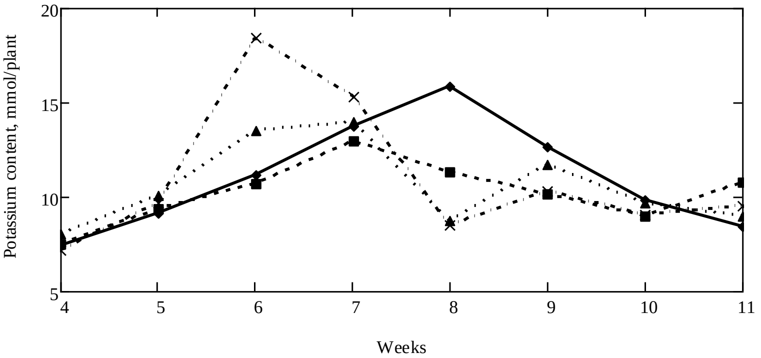

Figure 8. Dynamics of potassium content (mmol/plant) intomatoplants. - ♦ - ♦- variant 1, - ■ - ■ - variant 2, •▲• ▲•variant 3, - • -×- • -× variant 4.

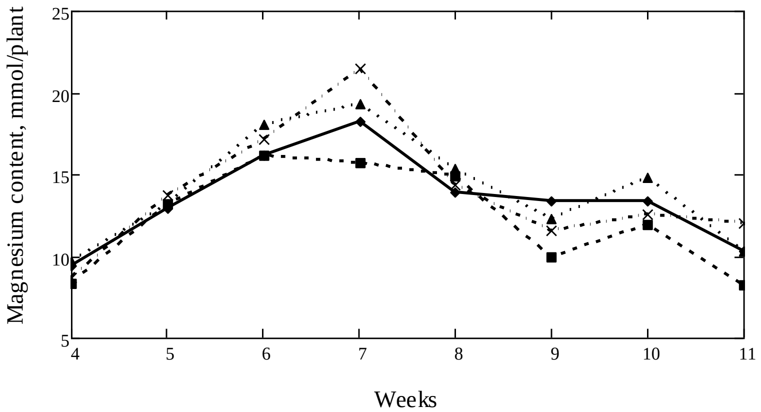

Figure 9. Dynamics of magnesium content (mmol/plant) intomato plants. - ♦ - ♦- variant 1, - ■ - ■ - variant 2, •▲• ▲•variant 3, - • -×- • -× variant 4.

Noticeably the influence of the composition TJAS on trend component that determines the general direction of the long-term evolution of chemical elements absorption processes by plants. So, for the third variant the content of calcium, nitrate nitrogen and phosphorus indicates the dynamics (trend) of reducing their absorption by plants during the vegetation. At the same time, the use of other compositions TJAS leads to inverse trend, that is, to increase the absorption of these elements by the end of the growing season. We found a significant absorption of nitrate nitrogen in the plants for variant 4, where there was no covering of the spunbond by TJAS, and seedlings were grown on the hydrophilic microporous plastic.

For all variants of the experiment the trend of magnesium shows that there is a reduction of magnesium absorption by the end of the growing season.The third variant is characterized by the minimum rate of descent of magnesium absorption. For the fourth variant we found maximum speed of reduction of magnesium absorption. Trends show the rise of the phosphorus absorption for all variants of the experiment by the end of the growing season. Trends for calcium, potassium and nitric nitrogen correlated. For the first and second variants there exists the trend of increase of the absorption of these elements in plants with the age of the plants. At the same time for the third and fourth options there exists cooperative decrease of their absorption. Composition of TJAS only affects the rate of the deterministic processes. As shown by the statistical analysis, the processes of absorption of nitrate nitrogen are carried out much more rapidly than for absorption of calcium and potassium. The authors [14] also indicate some commonality of the absorption dynamics by the tomato plants of Ca^{2+}, K^{+} and NO_3^-.

Experimental data have shown that the greatest quantitative distinction in the absorption of chemical elements is observed for variant 4. In this case sprouts were grown on microporous plastic, and mulch was not coated by TJAS. Indeed, we have found that the chronological average values for the absorption of potassium, magnesium, phosphorus and nitrate nitrogen are the largest for the variant 4. Mean calcium absorbtion in the variant 4 also sufficiently high, and only slightly inferior to the third variant. However, such the trend behavior of chemical elements absorption are not promoted increasing the productivity of plants for this variant. Here we should note that in the fourth variant missing the fine-dispersed organic and mineral components. These components facilitate the creation a more favorable the trophic environment, which affects the dynamics of plant transpiration and absorption dynamics of chemical elements by plants. Apparently, it has affected significantly the reduction of a plant productivity.

4. Conclusion

The studies showed that the use TJAS as new, thin-layer, ecologically clean, single-use rooting medium may be promising solution of the problem to maintain high productivity of plants under controlled conditions. TJAS provides for the conditions that close to the optimal living conditions for roots. TJAS not gives rise to perturbations in RIS that could affect the normal processes of nutrition of plant roots. For example, the intensive cultivation of plants on mineral RIS is accompanied by the transformation of their properties. This leads to a processes that analogous to the primary soil formation in natural conditions [1].

Application of TJAS for coating on synthetic, mineral and organic RIS can be regarded as the methodological basis for the optimization of the conditions of life support plant root system. Spectral analysis of the results of experiments on the transpiration of tomato plants showed that the main trend of the process of transpiration has a parabolic dependence and curve shape does not depend on the composition of TJAS. Changing of the composition of TJAS only shifts the maximum of the trend in the timeline and changes a value of the maximum.

Method of the spectral analysis of the one-dimensional time series allowed us to detect a structural difference in the periodicities of the processes of water-mineral metabolism in tomato plants for different of TJAS compositions. For example, the third variant, which gives the highest productivity of tomato plants, is characterized by two largest values of equal intensity periodicities, i.e., the periodicity of high-frequency (period $t_2^{(3)} = 2.8$ days (and nights); oscillation frequency is equal to $\omega_1^{(3)} = 0.714 \times \pi$, (days (and nights))$^{-1}$) and the periodicity of low-frequency (period $t_1^{(3)} = 18.7$ days (and nights); oscillation frequency, $\omega_1^{(3)} = 0.107 \times \pi$, (days (and nights))$^{-1}$. For the second and the fourth variants there exist also two periodicities with largest values of the intensities. However, them are the periodicities of low-frequency, with very close frequencies of oscillations. For these variants of TJAS it is characteristic smallest plant productivity. For the variant 1 in the mechanism of plant transpiration there exist only one maximum of the periodicity in the frequency range, which is missing in the other variants. The plant productivity in this variant is lower markedly of the productivity for the third variant. We also are noted that there exists a weak correlation between the productivity of tomato plants with the reciprocal of the maximum intensity of the principal periodicity of the plant transpiration.

Apparently, most favorable situation to maximize plant productivity, when the composition of TJAS creates the following conditions. Firstly, the mechanism of water use plants must be present at the same time the long-wave and short-wave frequency equal and maximum power. Secondly, the transpiration of plants should reach of the trend maximum for a very short time.

The experiment showed the prospectivity to use of TJAS for growing plants under controlled conditions. Using disposable of TJAS opens the possibility to implement hold of the RIS in the juvenile highly active state. This method may be promising for practical purposes the obtaining of ecologically clean plant products, modeling of effective soil analogues and to develop new ways to control plant productivity by optimizing the conditions of life support plant root system. Findings the comprehensive experimental material can be used as an information base for model studies in plant physiology, including water and mineral metabolism in almost perfect conditions of CAES.

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